February 20, 1997

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Federal Communications Commission
Office of Secretary

Mr. William Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W. - Room 222
Washington, D.C. 20554

<u>Ex Parte</u>: **CC Docket 96-45, Federal-State Joint Board on Universal Service**

CCB/CPD 97-2, Staff's Analysis of the Use of Computer Models for Estimating Forward-Looking Economic Costs

Dear Mr. Caton,

Today representatives of GTE met with William Sharkey, David Krech and Emily Hoffnar of the Universal Service Branch of the Common Carrier Bureau and Paul Pederson of the Missouri Public Service Commission, Brian Roberts of the California Public Utilities Commission, Tom Wilson of the Washington Utilities and Transportation Commission, Charles Bolle of the South Dakota Public Utilities Commission, Phil Mc Clelland of the Pennsylvania Office of Consumer Affairs, Sandra Makeef of the Iowa Utilities Board, and Barry Payne of the Indiana OUCC. The purpose of the meeting was to discuss the use of computer models for estimating forward-looking economic costs and the use of such models in determining universal service funding. The attached material served as point of discussion.

If you have any questions concerning this matter, please contact me at (202) 463-5293.

Sincerely,

W. Scott Randolph
Director - Regulatory Affairs

cc: Emily Hoffnar
      David Krech
      William Sharkey
      CC Docket 96-45 Universal Service Joint Board

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COST ESTIMATES FOR UNIVERSAL SERVICE

GTE

20 February 1997

I.   COST CONCEPT TO BE ESTIMATED

1)   Objective is to estimate market price of service

-   Market price is consistent with cost of firms in the market

-   Market price determination

    -   Actual cost

    -   Forward-looking cost

2)   Cost minimization problem facing the firm

-   Firm must minimize cost over time;

-   Cost problem is dynamic, not static

Factors firm must consider:

    -   Growth

    -   Change in input prices and technology

    -   Uncertainty

    -   Indivisibility

Cost problem is basically the same for incumbents and entrants

-   Firms can be more efficient if they solve problem better

-   Being an entrant does not automatically allow firm to have

    lower costs.

I. COST CONCEPT TO BE ESTIMATED (Cont'd.)

Forward-looking, long run cost is solution to dynamic cost minimization

- Involves placing plant over time - result is different vintages

- Placing all investment at once is not optimal

Models don't specify forward-looking cost correctly

- No time dimension

- No optimization

    - Tradeoffs not considered

    - Based on rules of thumb

    - Don't consider growth, price changes, uncertainty

    - Capture indivisibilities only partially

- Many errors in model specification, data

- Even if well specified, engineering simulation models are

    inherently unreliable as estimators of average cost levels

Why should embedded cost differ from forward-looking cost?

- Depreciation

- Changes in input prices, technology

    - Prices of capitalized inputs

    - Prices of inputs tied to capital mix

    - Other input prices

- ILEC inefficiency

- Model error

II.   VERIFICATION

- Reasonableness of inputs

- Comparison of models

- Validation of output against actual data

    - Intermediate outputs: route miles, loop length

    - Final output: cost

III. BASIC MODEL STRUCTURE AND DEMAND INPUTS

- Switch nodes

  - Model should use existing nodes

- Unit of Observation

  - Model should use combination of CBGs and smaller units

    - Census blocks or Grid squares

  - Existing models, especially Hatfield 3, do poor job of matching

    CBGs to wire centers

- Demand data - Number of Lines

  - Existing models use household data, employee counts

    - Results in poor estimate of lines

      - One wire center in Thousand Oaks CA has 38, 058

        total lines, but only 14,090 in Hatfield 3

  - GTE proposal:

    - Use actual wire center line counts   *ULLs provide under Protective Order?*   *GTE?*

      - Distribute residence lines in to CBGs in wire center

        based on relative households.

      - Distribute business lines to CBGs in wire center

        based on relative employees. Takes account of

        industry mix by wire center.

III.   BASIC MODEL STRUCTURE AND DEMAND INPUTS (Cont'd)

Demand assumptions - How to make static model reflect dynamic cost problem?

- GTE's proposals:

    1)   Realistic utilization rates that recognize need to allow for growth

         and uncertainty.

    2)   Switch costs that include life cycle: initial cost and additions

    3)   Rules of thumb for feeder and distribution placement that recognize

         placement over time in optimal units:

         - E.g., three 400 pair cables instead of one 1200 pair cable;

             - Three placement costs instead of one

    4)   Reasonable scenario with respect to market share

         - Efficient entrant will not serve 100% of demand

IV.   LOOP PLANT

Feeder assumptions

- Total loop length should not exceed 12,000 feet

- Where total length > 12,000, pair gain device should not be farther

  than 12,000 feet from customer.

  - BCPM consistent with these assumptions

  - Hatfield loop engineering inadequate

  - Insufficient in quality, quantity

Distribution assumptions

- Distribution length largely determined by street layout, which is

  below model's unit of observation.

- Distribution quantities determined by:

  - Length

  - Indivisibilities

  - Fill assumptions

- Distribution results controlled by structure of algorithm in model

  - BCPM algorithm better

  - Hatfield 3.0 performs better than 2.2.2, but still poorly

  - Need to validate against actual data

IV.   LOOP PLANT (Cont'd)

Fill assumptions

- Achievable fill depends on indivisibility, growth, uncertainty, reliability needs, allowance for breakage

- Competition causes utilization to go down, not up

  - Design fill: trigger for optimal increment to capacity

  - Actual fill: fill level achieved over time - average of stair-step solution

  - Static fill: Fill achieved in output of static model because of rounding up to next cable size

- In real life, there is an optimal level of fill. Raising fill in model appears to reduce cost because model does not optimize

- Models don't have actual data on fill, or any way to determine fill

GTE proposal: Choose model input so as to force static fill in model output to equal observed actual fill: 65% for feeder, 30-40% for distribution

Hatfield 3.0 does not accurately predict quantity of cable, or level of cost.

- See accompanying charts

IV.   LOOP PLANT (Cont'd)

Structure:

- Sharing assumptions in Hatfield 3.0 are unreasonable

  Actual GTE sharing percentages (as a percentage of cost):

  - Buried: 97.5%

  - Underground: 95-99%

  - Aerial: 57-61%

  These percentages are unlikely to change in the future

- Hatfield assumptions about structure mix are silly

  - 85% Aerial in "downtown urban areas"

V.   SWITCHING

- Switch cost should

    - Recognize indivisibility of getting-started cost

    - Recognize life-cycle of switch

- Hatfield switch curve based on silly "data"

    - Underestimates GTE's switch cost by almost half, when

      compared to actual competitive bids in California

        - Hatfield cost = ~ .558 of GTE's cost

VI. CAPITAL COSTS

- Cost of capital must be forward-looking

    - Consistent with Joint Board recommendation, other forward-looking model assumptions

    - Cost of capital assumed in Hatfield 3.0 is not forward-looking

    - Effects of competition, uncertainty

    - In future, ILEC capital costs will be comparable with those of competitors.

        - Even if this were not true, assuming a low "ILEC" cost is not consistent with cost of efficient entrant. Entrants could not earn return which would justify their investment.

- Depreciation must be forward-looking

    - Effects of input prices, technology

    - Hatfield sponsors can't have it both ways: if new network can be built for half of ILEC's book cost, then past depreciation cannot have been adequate.

    - Current prescribed rates are not forward-looking

        - Have not even been adequate in the past

        - GTE estimates shortfall at $7.1 Billion.

    - Evidence from other firms

        - The likely "efficient entrants" all use much shorter lives

VII.   EXPENSES

Problem of estimating forward-looking expenses

- Current actual expenses are best starting point

- Models provide no basis for estimating how expenses will change in future. Parties' claims of much lower expenses in future are not based on any sound evidence.

GTE's recommendation:

- Commission has been estimating future change in ILEC's costs in price cap proceeding since 1990

- Has always relied solely on evidence of ILEC productivity in recent past.

  - Underlying process changes over time, but not in a discontinuous way

  - Commission has rejected claims that future productivity gains will differ from recent experience, based on "outside" information

- Commission should forecast next period expenses, based on recent actual experience, using accepted statistical forecasting techniques.

VII. EXPENSES (Cont'd)

Structure of expenses in models

- Both per-line and investment factor approaches raise concerns

- Application of expense factors to underestimated investment

- GTE recommends:

    - Expenses estimated statistically

    - Estimates stratified by study area size to capture scale economies

Joint and Common Costs

- Joint and Common Cost should include all amounts in the following USOA accounts:

21XX	-	General Support Costs
61XX	-	Plant Specific Operations
65XX	-	Plant Non-Specific Operations
67XX	-	Corporate Operations Costs

- Hatfield adopts arbitrary 10% allowance for 67XX

- Hatfield either ignores, or arbitrarily allocates other accounts

    - These expenses are not attributable. They should be captured as common.

    - Hatfield arbitrarily reduces some expenses, fails to include others.

VII. EXPENSES (Cont'd)

Retail Costs

- Hatfield assumes minimal customer service expenses, ignores marketing expenses

- Competition will increase forward-looking retail expenses

    - Confirmed by experience in IX market

- Retail expenses should be consistent with avoidable cost estimates established by states

    - The cost the ILEC saves by not having the retail customer should be the same as the cost the ILEC incurs if it does have the retail customer

- GTE's recommendation:

Derive total cost based on estimate of other cost, and avoided cost percentage:

Total cost = estimate of other costs / (1 - state wholesale discount)

Comparison of Actual GTE Service Area in Texas
to Release 3 Representation of GTE Service Area

Legend
- ☐ Texas
- ■ Excess Release 3 Representation of GTE Service Area
- ■ GTE Service Area Not Omitted by Release 3 Representation
- ■ GTE Service Area Omitted by Release 3 Representation
- ☐ County Boundaries

Miles

0   40   80   120
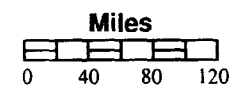
Comparison of Actual GTE Service Area in Texas to Release 3 and 2.2.2 Representations of GTE Service Area

Legend

☐ Texas

Actual GTE Service Area

⟋ Release 3 Representation of GTE Service Area

⟍ Release 2.2.2 Representation of GTE Service Area

☐ County Boundaries

Miles

0   40   80   120
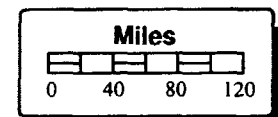
Comparison of Actual GTE Service Area in Washington to Release 3 Representation of GTE Service Area

Legend

☐ Washington

Actual GTE Service Area

■ Excess Release 3 Representation of GTE Service Area

■ GTE Service Area Omitted by Release 3 Representation

Scale (miles)

0 10 20 30 40 50 60

Comparison of Actual GTE Service Area in Washington to Release 2.2.2 and 3 Representations of GTE Service Area

Legend

☐ Washington

Actual GTE Service Area

⁄⁄ Release 3 Representation of GTE Service Area

⟍⟍ Release 2.2.2 Representation of GTE Service Area
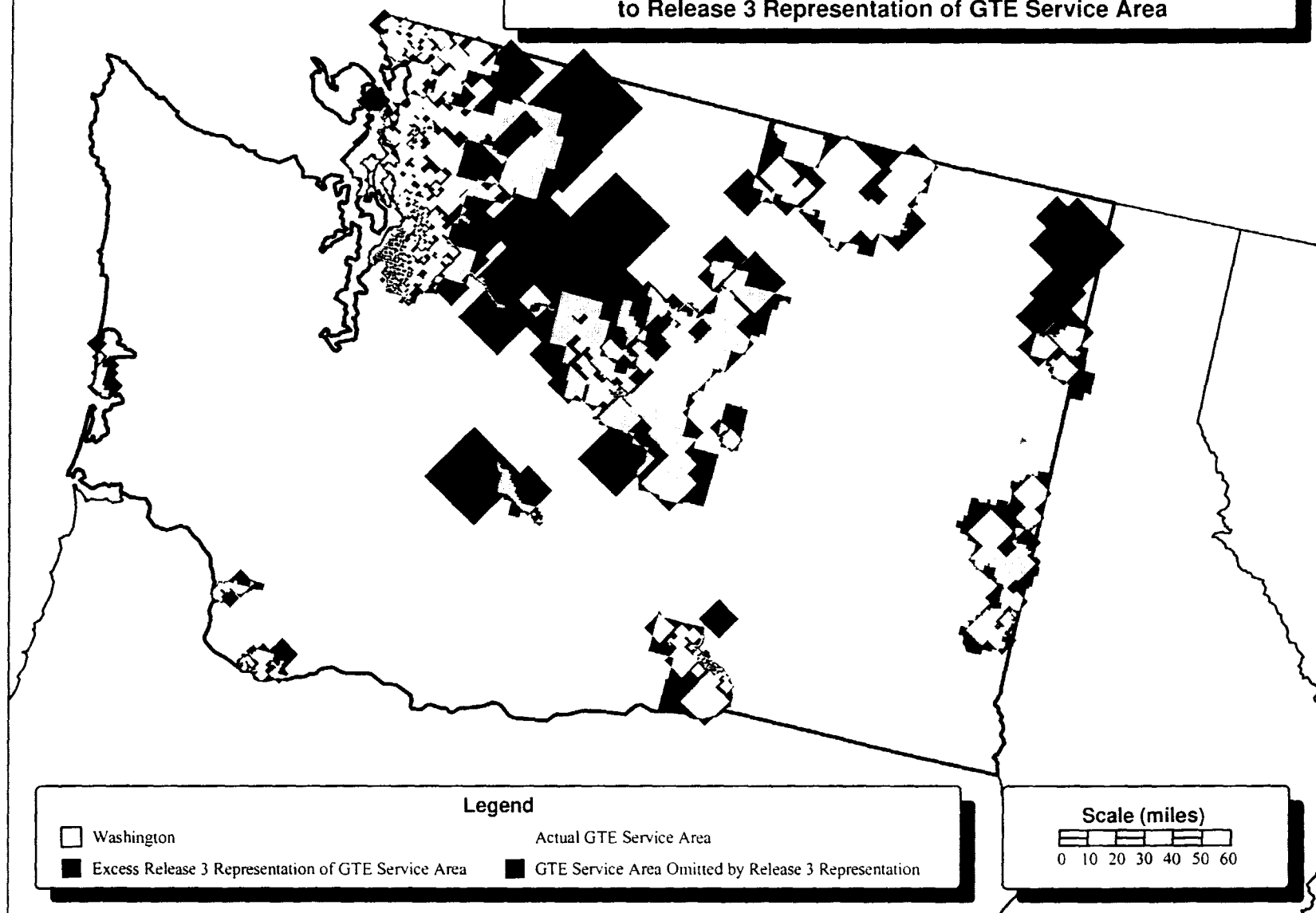
Scale (miles)

0　10　20　30　40　50　60

Comparison of Actual GTE Service Area in California
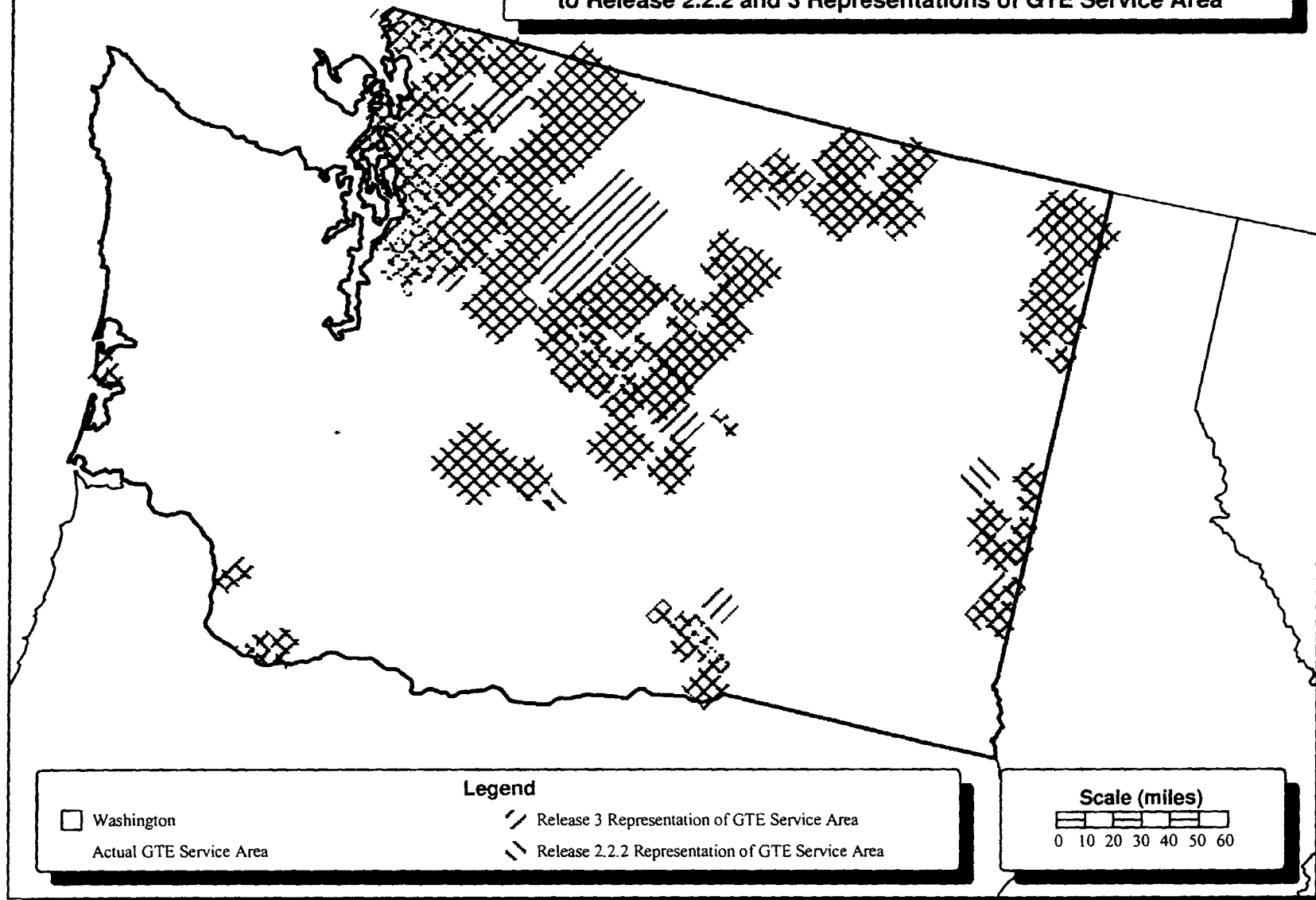## to Release 3 and 2.2.2 Representations of GTE Service Area

Legend

☐ California

Actual GTE Service Area

╱ Release 3 Representation of GTE Service Area

╲ Release 2.2.2 Representation of GTE Service Area

Miles

0   20   40   60
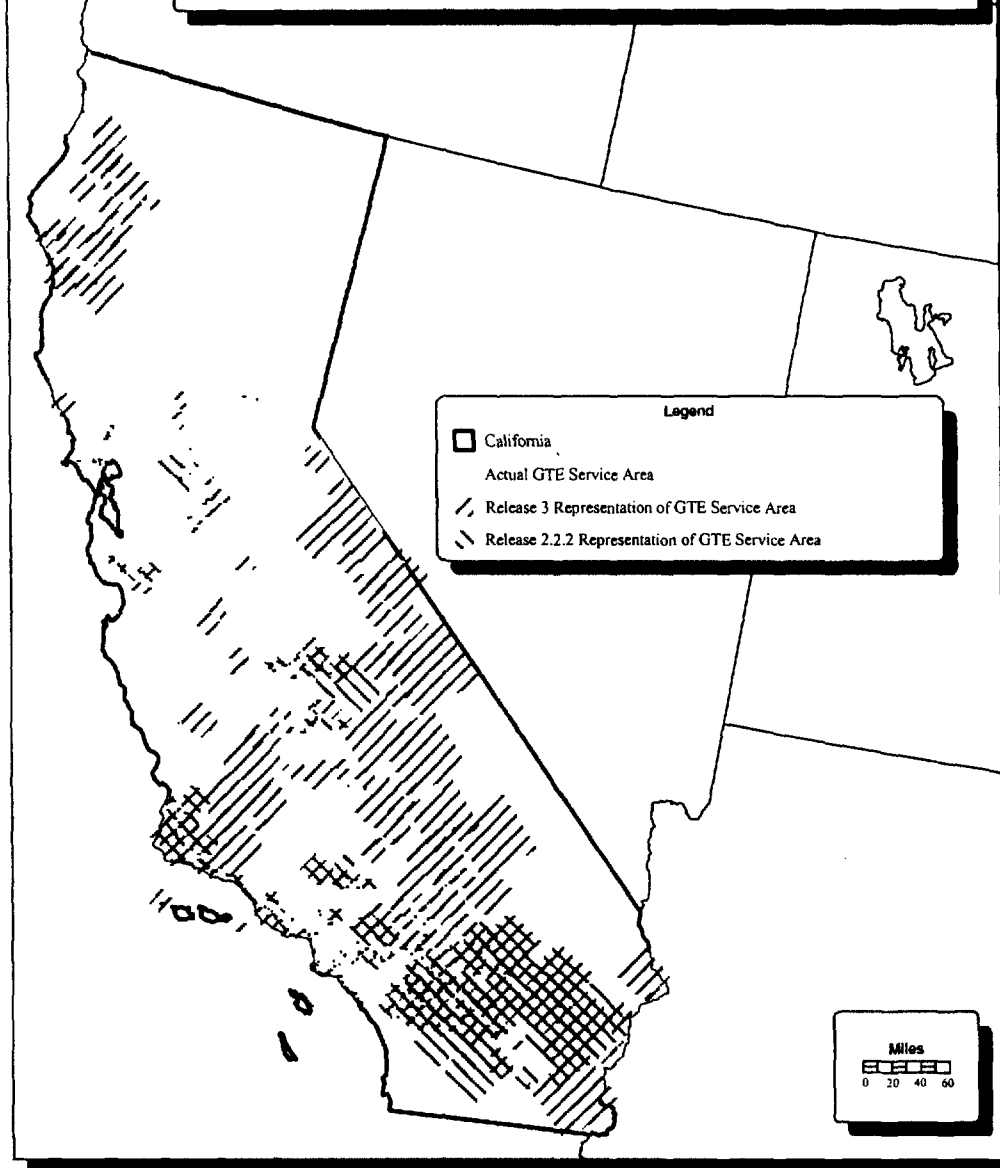
Comparison of Hatfield Model Release 3 and 2.2.2 Distribution Distances
with Sums of Street Segment Lengths in Sample California CBGs

CBG 60650438.063

Distribution Distance

Release 3:   25.2 miles

Release 2.2.2:   3.0 miles

Sum of Street Segment Lengths

74.4 miles
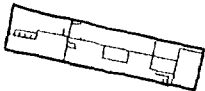
CBG 60650443.002

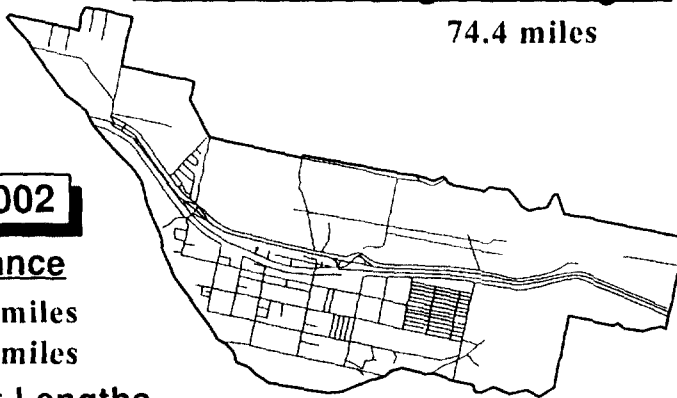## Distribution Distance

Release 3:   12.5 miles

Release 2.2.2:   0.8 miles
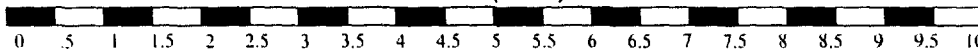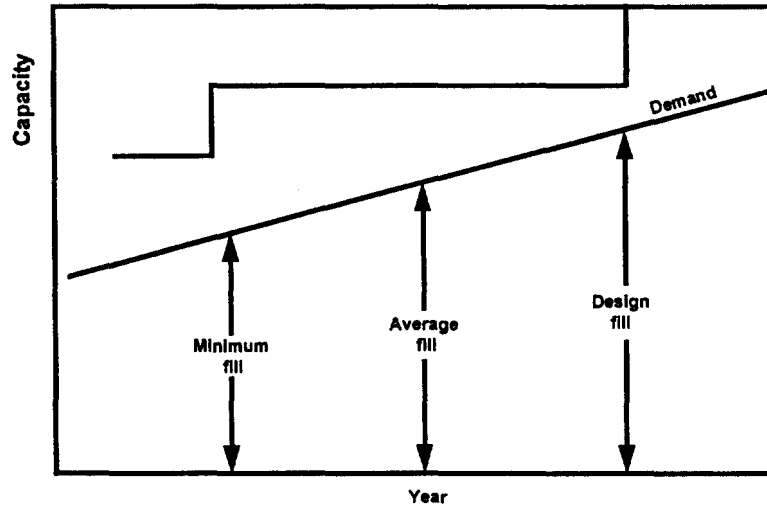
Sum of Street Segment Lengths

7.6 miles

Scale (miles)

| 0 | .5 | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |

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Figure 2
FEEDER CABLE UTILIZATION

Cost of Service for Selected CBGs in Washington - GTE

CBGs Served	Penetration Rate	Monthly Cost Per Loop	Number of Loops Served	Average Loop Length (Feet)	Distribution Investment Per Loop	Feeder Investment Per Loop	Switching Investment Per Loop	CBGs Per Wire Center
Randomly Selected CBGs								
145	100%	$39.14	77,147	20,791	$977	$402	$178	5.4
145	65%	$50.65	50,146	20,791	$1,436	$497	$210	5.4
145	50%	$59.73	38,574	20,791	$1,821	$562	$223	5.4
100	100%	$41.48	51,926	21,592	$1,023	$441	$208	3.8
100	65%	$54.06	33,752	21,592	$1,508	$544	$259	3.8
100	50%	$63.79	25,963	21,592	$1,911	$626	$270	3.8
50	100%	$45.81	22,431	21,150	$1,091	$477	$316	2.4
50	65%	$60.55	14,580	21,150	$1,598	$597	$433	2.4
50	50%	$72.49	11,216	21,150	$2,030	$678	$522	2.4
Systematically Selected CBGs Close to Wire Center								
145	100%	$39.14	77,147	20,791	$977	$402	$178	5.4
145	65%	$50.65	50,146	20,791	$1,436	$497	$210	5.4
145	50%	$59.73	38,574	20,791	$1,821	$562	$223	5.4
100	100%	$32.29	58,542	12,801	$732	$289	$185	4.5
100	65%	$41.08	38,053	12,801	$1,073	$346	$234	4.5
100	50%	$48.10	29,271	12,801	$1,356	$374	$278	4.5
50	100%	$25.76	31,063	6,735	$556	$121	$198	4.2
50	65%	$32.63	20,191	6,735	$829	$144	$250	4.2
50	50%	$38.55	15,531	6,735	$1,058	$164	$301	4.2

Source: BCM2

Prepared by David Salant and John Holzwarth
For Paul Milgrom

Cost of Service for Selected CBGs in Washington - U S West

CBGs Served	Penetration Rate	Monthly Cost Per Loop	Number of Loops Served	Average Loop Length (Feet)	Distribution Investment Per Loop	Feeder Investment Per Loop	Switching Investment Per Loop	CBGs Per Wire Center
Randomly Selected CBGs								
575	100%	$27.13	404,197	14,567	$550	$291	$107	28.8
575	65%	$33.38	262,728	14,567	$814	$340	$114	28.8
575	50%	$38.80	202,098	14,567	$1,048	$378	$119	28.8
320	100%	$27.16	221,753	13,515	$543	$288	$118	16.0
320	65%	$33.49	144,140	13,515	$803	$339	$131	16.0
320	50%	$38.99	110,877	13,515	$1,036	$380	$138	16.0
100	100%	$27.66	73,538	13,696	$506	$314	$150	5.9
100	65%	$34.29	47,800	13,696	$748	$380	$181	5.9
100	50%	$40.21	36,769	13,696	$970	$430	$210	5.9
Systematically Selected CBGs Close to Wire Center								
575	100%	$27.13	404,197	14,567	$550	$291	$107	28.8
575	65%	$33.38	262,728	14,567	$814	$340	$114	28.8
575	50%	$38.80	202,098	14,567	$1,048	$378	$119	28.8
320	100%	$23.54	234,906	8,385	$469	$182	$116	16.8
320	65%	$28.90	152,689	8,385	$703	$210	$127	16.8
320	50%	$33.57	117,453	8,385	$909	$233	$138	16.8
100	100%	$21.09	72,111	4,458	$429	$52	$159	5.6
100	65%	$26.05	46,872	4,458	$643	$57	$192	5.6
100	50%	$30.46	36,056	4,458	$833	$65	$220	5.6

Source: BCM2

Figure 4

Calculation of Distribution Fill

Cross-Connect Box

Feeder Cable from the C.O.   Feeder Cable Continued

Area #1

200 pairs   1-125+75xd

Area #3

Area #2

Parkland Woods Court

25 pairs   50 pairs

51-66+10xd   76-109+16xd   Vinson Court

Parkland woods Dr

50 pairs   1-41+9xd

Area #4

Piedmont Court   25 pairs

26-37+13xd

25 pairs   1-14+11xd

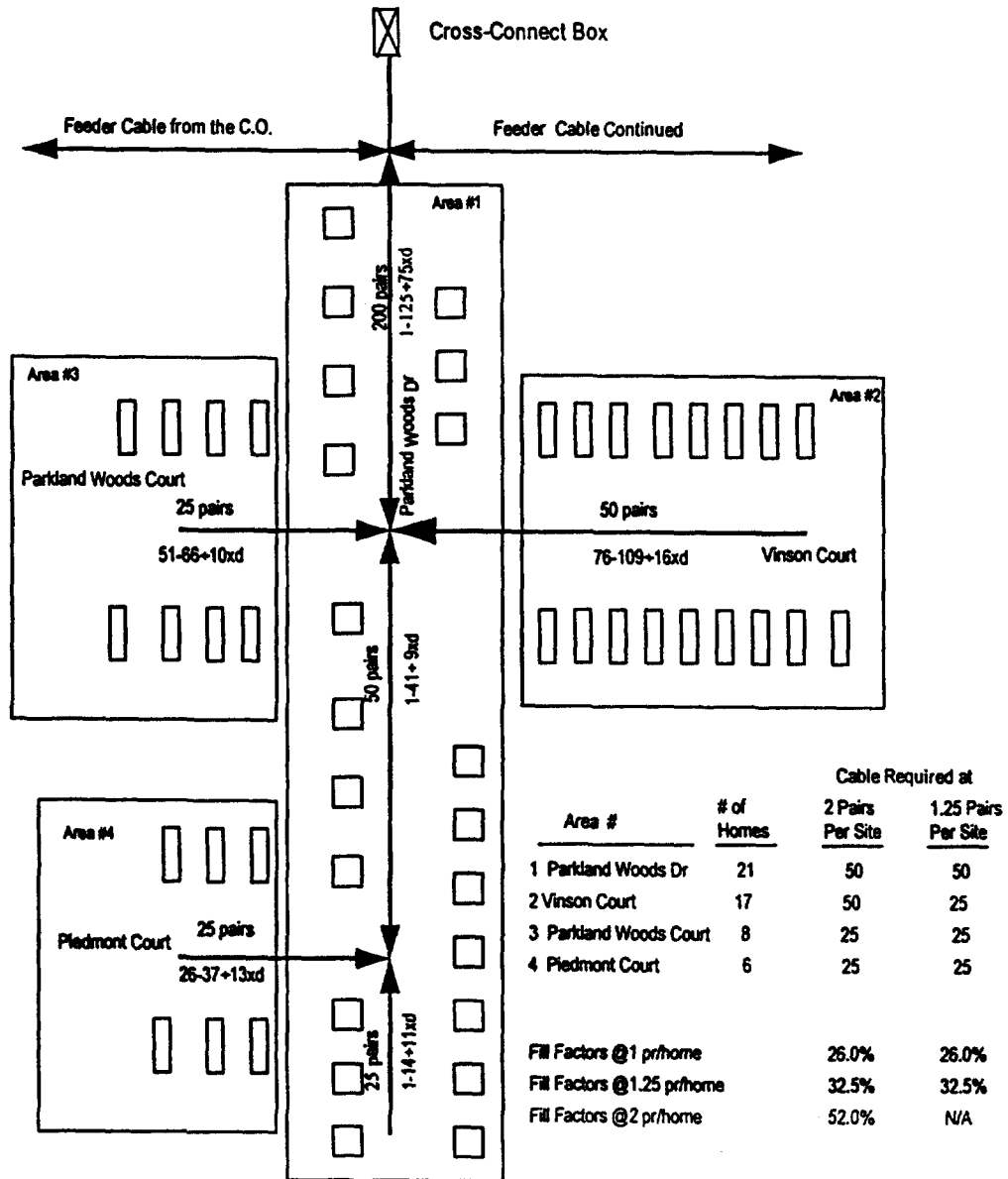| Area #	# of Homes	Cable Required at	
		2 Pairs Per Site	1.25 Pairs Per Site
1 Parkland Woods Dr	21	50	50
2 Vinson Court	17	50	25
3 Parkland Woods Court	8	25	25
4 Piedmont Court	6	25	25
Fill Factors @1 pr/home		26.0%	26.0%
Fill Factors @1.25 pr/home		32.5%	32.5%
Fill Factors @2 pr/home		52.0%	N/A

Table 1

Comparison of Copper Feeder and Distribution Cable Investment
Actual GTE vs. Hatfield Model 2.2.2

Hatfield Area Adjusted to Match Actual

State	Wire Center	Feeder and Distribution Sheath Miles[1]		Ratio of Copper Cable Investment Hatfield/GTE
		Actual[1]	per Hatfield	
(1)	(2)	(3)	(4)	(5)
				(4)/(3)
California	Arrowhead	262.4	40.0	0.15
California	Banning	510.8	202.2	0.40
California	Pinyon	110.5	42.0	0.38
California	Carpenteria	159.9	59.4	0.37

[1] Actual Sheath Miles are estimated by actual street miles.

Source: Actual data: U.S. Streets Data Technology Inc., U.S. Streets 95 CD-Rom.
Hatfield data: State specific BCM Loop Module of the Hatfield Model 2.2.2.